# Measurement of the CP Violating phase $\varphi_s$ at LHCb
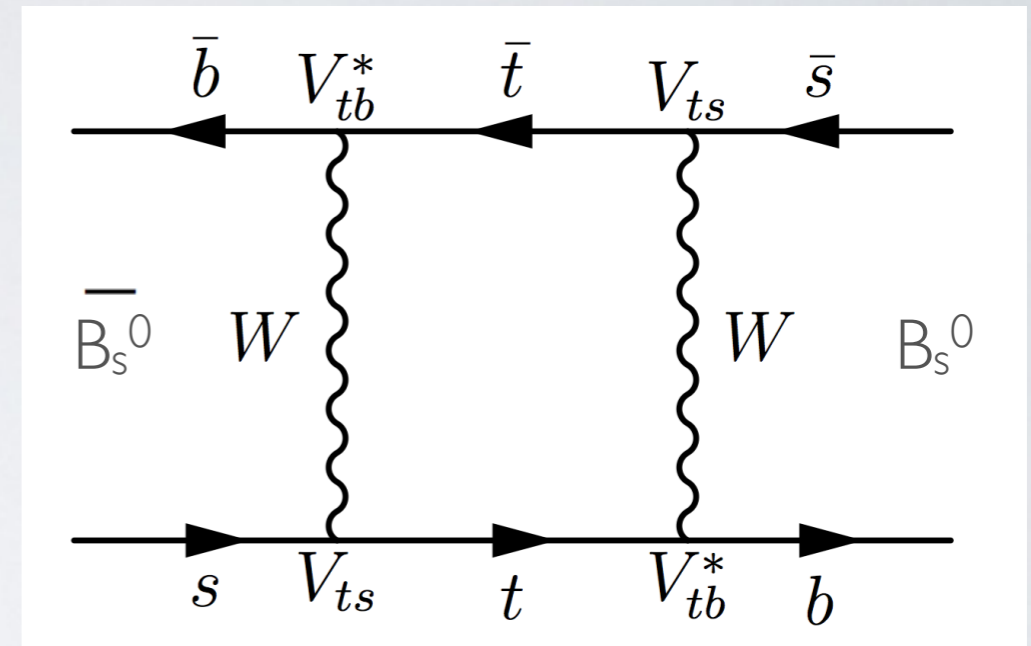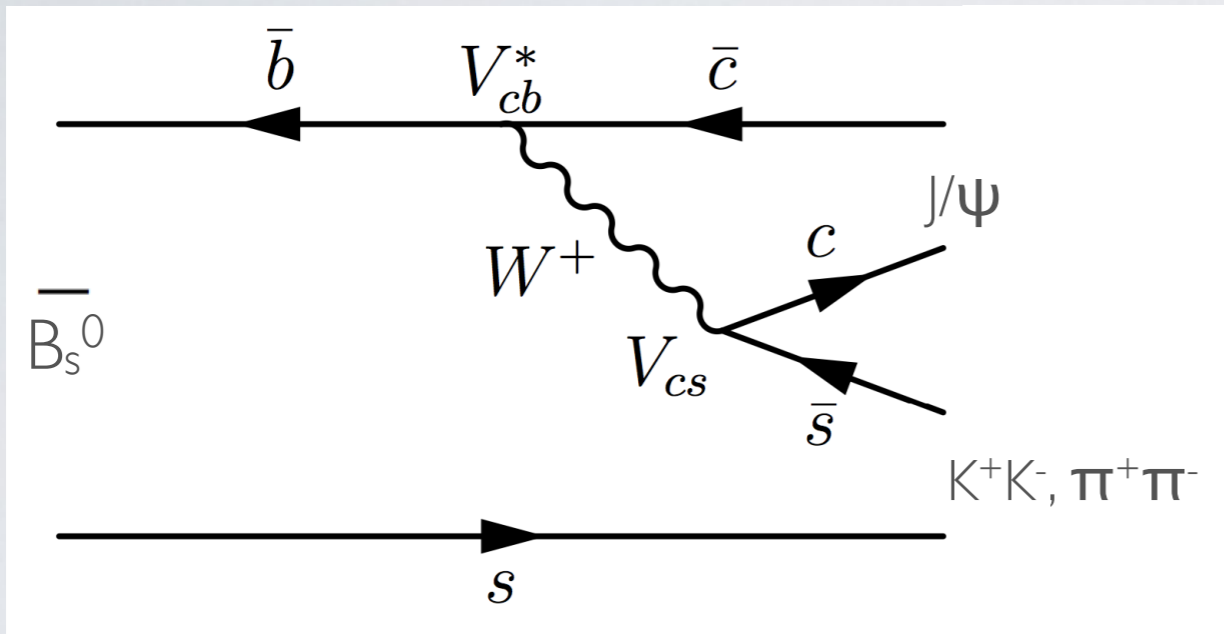
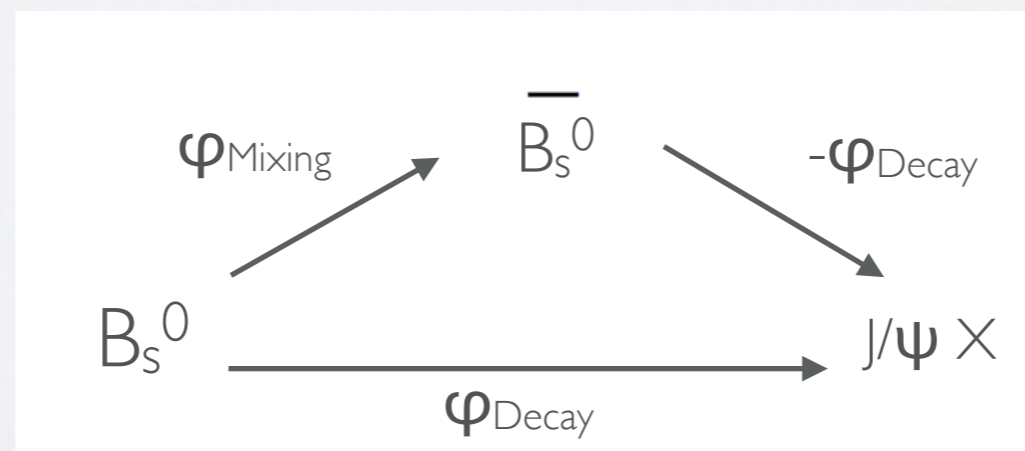## Beauty 2014

## The University of Edinburgh



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# Phenomenology



- CP Violation through the interference between mixing and decay.
- Theoretical prediction: $\varphi_s = -0.0363 ^{+0.0016}_{-0.0015}$ rad.  arXiv:1106.4041v2 [hep-ph] 18 Aug 2011
- New Physics!

# Results

**$B_s^0 \rightarrow J/\psi\ K^+K^-$: 1fb$^{-1}$**

$\Gamma = 0.663 \pm 0.005(\text{stat.}) \pm 0.006(\text{syst.})$ ps$^{-1}$
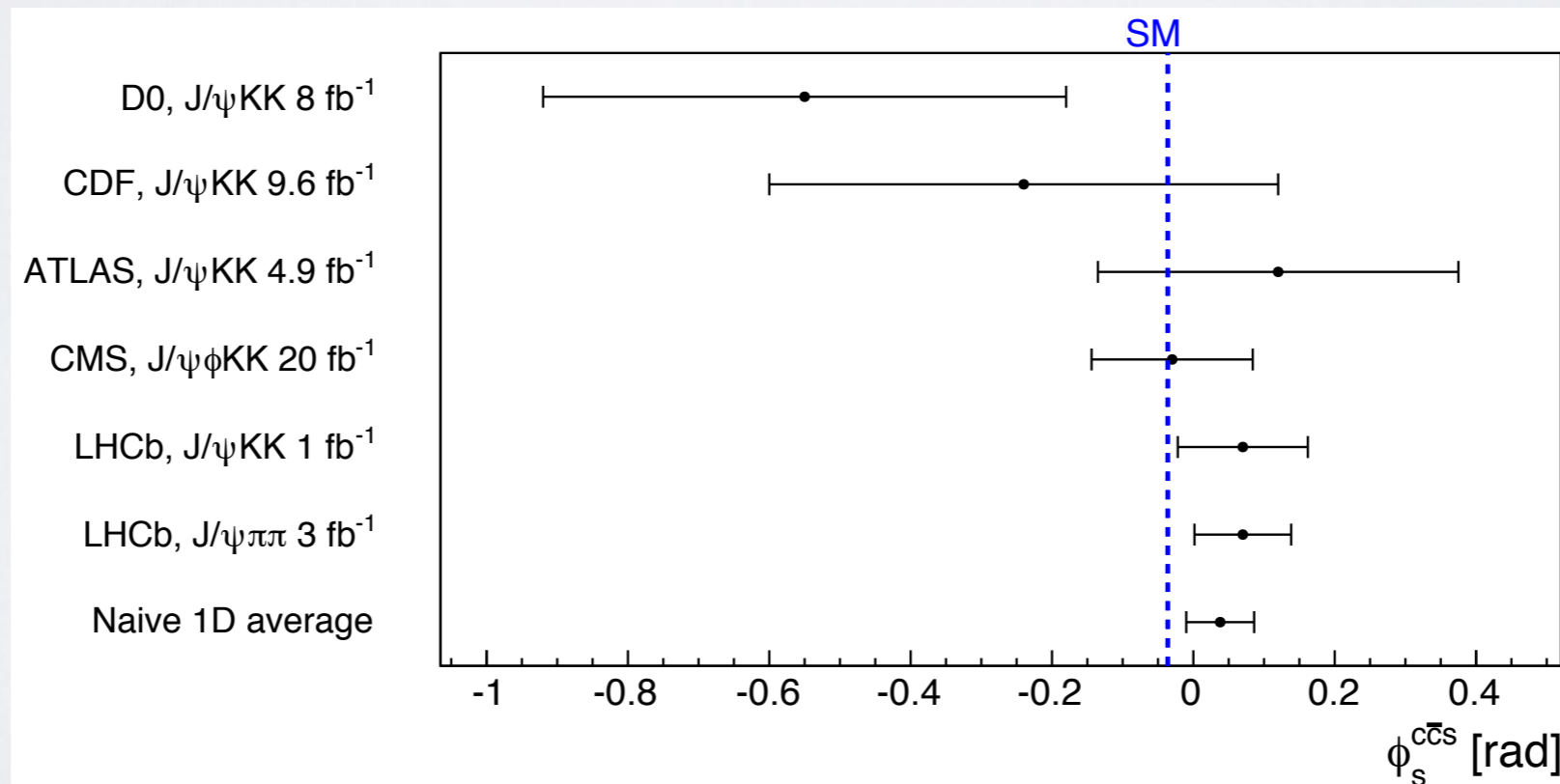
$\Delta\Gamma = 0.100 \pm 0.016(\text{stat.}) \pm 0.003(\text{syst.})$ ps$^{-1}$

$\varphi_s = 0.07 \pm 0.09(\text{stat.}) \pm 0.01(\text{syst.})$ rad

**$B_s^0 \rightarrow J/\psi\ \pi^+\pi^-$: 3fb$^{-1}$**

$\varphi_s = 0.070 \pm 0.068(\text{stat.}) \pm 0.008(\text{syst.})$ rad

**Combining $B_s^0 \rightarrow J/\psi\ K^+K^-$ : 1fb$^{-1}$, and $B_s^0 \rightarrow J/\psi\ \pi^+\pi^-$: 3fb$^{-1}$**

$\varphi_s = 0.070 \pm 0.055(\text{stat.}) \pm 0.011(\text{syst.})$ rad

# Future

- Updated $B_s^0 \rightarrow J/\psi\, K^+K^-$ using $3fb^{-1}$ of data.
- Study new modes for measurements of $\varphi_s$.
  - $B_s^0 \rightarrow \psi(2S)\, \varphi$
- Looking forward to Run 2 data!